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(19) (CA) **APPLICATION FOR CANADIAN PATENT** (12)

(54) Hard, Durable Nail Polish and Method of Forming

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(30) (US) 605,074 1990/10/25

(57) 15 Claims

Notice: The specification contained herein as filed

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Handwritten notes:
#1111 P.9
50-80% urethane ac
2-20% THP ethox triac
5-14% MAA
3-20% OHGHP ketone

ABSTRACT OF THE DISCLOSURE

The method of strengthening a fingernail or toenail, that includes cleaning the nail surface; applying onto the fingernail or toenail at least one layer of a nail polish composition consisting of:

5 (1) about 74 weight percent aliphatic urethane acrylate and tripropylene glycol diacrylate, (2) about 10 weight percent trimethylolpropane ethoxylate triacrylate, (3) about 10 weight percent methacrylic acid, (4) about 5

10 weight percent 1-hydroxycyclohexylphenyl ketone, (5) between .5 and 1.5 weight percent butyl acetate; and subjecting the layer or layers to ultraviolet radiation treatment to cure the layer, the radiation treating including applying between .50 and 1.50 milliwatts per

15 square centimeter of the radiation for about 30 to 60 seconds; the composition containing colorant particles which consist essentially of metal salts selected from the group consisting of iron oxide, mica bismuth oxychloride, titanium dioxide, and manganese oxide; and

20 wherein the method includes initially applying a layer of hydrocarbon primer to the surface, and allowing the primer layer to cure, the primer consisting essentially of a mixture of methacrylic acid, benzyl alcohol, and isobutyl methacrylate.

I CLAIM:

1. The method of strengthening a fingernail or toenail, that includes

a) cleaning the nail surface,

b) applying onto the fingernail or toenail
at least one layer of a nail polish composition
consisting of:

(1) about 74 weight percent aliphatic
urethane acrylate and tripropylene
glycol diacrylate

(2) about 10 weight percent
trimethylolpropane ethoxylate
triacylate

(3) about 10 weight percent methacrylic
acid

(4) about 5 weight percent 1-
hydroxycyclohexylphenyl ketone

(5) between .5 and 1.5 weight percent
butyl acetate

c) and subjecting said layer or layers to
ultraviolet radiation treatment to cure the layer, said
radiation treating including applying between .50 and
1.50 milliwatts per square centimeter of said radiation
for about 30 to 60 seconds,

d) said composition containing colorant
particles which consist essentially of metal salts
selected from the group consisting of iron oxide, mica
bismuth oxychloride, titanium dioxide, and manganese
oxide,

e) and wherein the method includes initially applying a layer of hydrocarbon primer to said surface, and allowing the primer layer to cure, said primer consisting essentially of a mixture of methacrylic acid, benzyl alcohol, and isobutyl methacrylate.

2. The method of strengthening a fingernail or toenail, that includes

a) cleaning the nail surface,
b) applying onto the fingernail or toenail at least one layer of a nail polish composition consisting of:

(1) between 50 and 80 weight percent
aliphatic urethane acrylate

(2) between 2 and 21 weight percent
trimethylolpropane ethoxylate
triacrylate

(3) between 5 and 14 weight percent
methacrylic acid

(4) between 3 and 20 weight percent 1-
hydroxycyclohexylphenyl ketone

c) and subjecting said layer or layers to ultraviolet radiation treatment to cure the layer, said radiation treating including applying between about .50 and 1.50 milliwatts per square centimeter of said radiation for about 30 to 60 seconds,

d) and wherein the method includes initially applying a layer of hydrocarbon primer to

said surface, and allowing the primer layer to cure.

3. The method of claim 2 wherein polish composition consists of one of the following Gel 1 through Gel 5:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
GEL 1	75-80	5-10	5-10	3-5	-	-	-
GEL 2	60-65	2-5	10-14	15-20	-	-	5.25
GEL 3	50-63	15-21	8-10	5-10	-	-	-
GEL 4	75-80	5-10	5-10	3-5	0.1-1.5	-	-
GEL 5	60-65	2-5	10-14	15-20	-	0.1-0.8	5-25

where (1) is weight percent aliphatic urethane acrylate

50-80%

(2) is weight percent trimethylolpropane
ethoxylate triacrylate

2-21%

(3) is weight percent methacrylic acid

(4) is weight percent 1-hydroxycyclohexylphenyl
ketone

3-20%

(5) is weight percent colorant

(6) is weight percent colorant

(7) is fumed silica.

4. The method of claim 4 wherein the colorant includes one of the following pigments, or mixture of different ones of the following pigments:

TiO₂ White
Diarylide Yellow
Yellow Oxide
Lead Free Yellow
Organic Yellow
Red Oxide
Arylide Red
Quinacridone Red
Phathalo Blue R
Phathalo Green B
Phathalo Green Y
Carbon Black
Burnt Umber
Lead Free Orange
Quinacridone Violet

5. The method of claim 4 wherein said colorant also includes a polymer resin mixed with said pigment.

6. The method of claim 2 wherein a second layer of said nail polish composition is then applied onto said cured layer, and allowed to cure, said curing also including ultraviolet treatment.

7. The method of claim 2 wherein said nail includes a natural nail, and an artificial nail attached to said natural nail and projecting beyond the end thereof to provide a common nail surface to which said layer or layers are applied.

8. The method of claim 2 wherein said nail includes a natural nail, and including providing a nail form having an upper surface projecting endwise of and beyond the end of the natural nail surface, and also applying said layer or layers of claim 1 to said form upper surface, and including carrying out said ultraviolet curing step with respect to said layer or layers applied to said form and finally removing said form.

9. The method of claim 2 wherein said primer consists essentially of a mixture of methacrylic acid, benzyl alcohol, and isobutyl methacrylate.

10. The polish protected nail as produced by the method of claim 1.

11. The polish protected nail as produced by the method of claim 2.

12. The method of strengthening a fingernail or toenail that includes

a) cleaning the nail surface and applying a hydrocarbon primer to said surface, and curing the primer,

b) applying to the cured primer at least one layer of nail polish composition consisting essentially of

(1) between 50 and 80 weight percent aliphatic urethane acrylate

(2) between 2 and 21 weight percent trimethylolpropane ethoxylate triacrylate

(3) between 5 and 14 weight percent methacrylic acid

(4) between 3 and 20 weight percent 1-hydroxycyclohexylphenyl ketone

c) and subjecting said layer or layers to ultraviolet radiation treatment to cure the layer or layers.

13. The method of claim 12 wherein the polish composition consists of one of the Gel 1 through Gel 5 compositions as defined in claim 3.

14. A nail polish composition, applicable to a fingernail or toenail, and hardenable under ultraviolet radiation, that consists essentially of a mixture of

- (1) between 50 and 80 weight percent aliphatic urethane acrylate
- (2) between 2 and 21 weight percent trimethylolpropane ethoxylate triacrylate
- (3) between 5 and 14 weight percent methacrylic acid
- (4) between 3 and 20 weight percent 1-hydroxycyclohexylphenyl ketone.

15. The polish composition of claim 14 wherein the composition further has one of the Gel 1 through Gel 5 formulations as defined in claim 3.

BACKGROUND OF THE INVENTION

This application is a continuation-in-part of
Serial No. 215,341 filed July 5, 1988, which is a
continuation-in-part of Serial No. 849,011 filed
5 April 7, 1986.

This invention relates generally to nail
polish applicable to fingernails and toenails; more
specifically, it concerns a process employing color
coatings applied to nails and ultraviolet radiation
10 treatment of such coatings, to produce extremely
durable polishes, which also act to support and protect
nails. The latter include natural nails, and
alternatively natural and artificial nail composites.

There is need for extremely durable nail
15 polishes that do not easily chip. There is also need
for a simple, effective, reliable process to produce
nail polish hardenable and protected natural, and also
composite natural and artificial, fingernails and
toenails. Prior nail polishes lacked the unusual
20 application steps and improved results, i.e., extremely
durable polishes, and polish protected nails
characterized by the present invention. Also, prior
polishes containing ultraviolet photo initiators were
difficult to flow onto natural and artificial nails,
25 and did not form sufficiently even surfaces.

SUMMARY OF THE INVENTION

It is a major object of the invention to provide a nail polish, and a polish forming or application process, meeting the above needs.

5 Basically, the process of the invention comprises the steps:

- a) cleaning the nail surface,
- b) applying at least one layer of a nail

polish composition consisting essentially of:

- 10 (1) aliphatic urethane acrylate and tripropylene glycol diacrylate (50-80 weight percent)
- (2) trimethylolpropane ethoxylate triacrylate (2-20 weight percent)
- 15 (3) methacrylic acid (adhesion promoter) (5-14 weight percent)
- (4) 1-hydroxycyclohexylphenyl ketone (photo initiator) (3-20 weight percent)

20 c) and subjecting the layer or layers to ultraviolet radiation treatment to cure the layer or layers.

Additional features and steps of the invention include: the application of a second layer
25 of the polish composition to the ultraviolet cured first layer, the gel in each layer consisting of an ultraviolet polymerizable gel containing five components; the application of the polish composition to both natural and artificial nails to build up

protective and polish forming layers extensively overlapping both such nails, which are only initially joined at their terminals; and the application of one or more such layers to a nail form used to build up a
5 nail extension forwardly of the tip of a natural nail, the resultant nail extension being colored throughout.

These and other objects and advantages of the invention, as well as the details of an illustrative embodiment, will be more fully understood from the
10 following specification and drawings, in which:

DRAWING DESCRIPTION

Fig. 1 is a process flow diagram;

Fig. 2 is a vertical section taken through a fingernail onto which a hardened polish layer or layers
15 have been applied;

Fig. 3 is a view like Fig. 2 also showing a fingernail tip, i.e., artificial fingernail, to which the hardened polish layer or layers have been applied;

Fig. 4 is a view like Fig. 2 but also showing
20 the use of a removable form onto which the hardened polish layer or layers have been applied;

Fig. 5 is a vertical section showing ultraviolet radiation treatment of fingernails to which a polish layer or layers have been applied; and

25 Fig. 6 is an enlarged section showing the polish matrix of particles and hardened gel, applied to a nail.

DETAILED DESCRIPTION

In Fig. 2, fingernail 10 is to undergo treatment. It is first buffed at 20 (in Fig. 1) to roughen its top surface. Next, it is cleaned at 21, as
5 by application of a liquid hydrocarbon cleaner, and preferably trichloroethane. After drying, a primer coat 11 is brushed onto the cleaned nail surface, as indicated at 22 in Fig. 1, to condition that surface. The primer preferably has an acrylate base, and
10 preferably consists of a mixture of methacrylic acid, isobutyl methacrylate, and benzyl alcohol, in the following proportions:

	<u>Weight %</u>
methacrylic acid	about 74%
15 isobutyl methacrylate	about 24%
benzyl alcohol	about 2%

After drying of the primer for about 45 seconds, indicated at 23, a viscous, flowable polish layer 12 is brushed, i.e., applied onto the dried
20 primer layer 11, this step shown at 24. Layer or coating 12 is ultraviolet radiation sensitive, and adapted to harden and protect, when such radiation is applied. The layer 12 contains an ultraviolet
25 sensitive polymer gel, and the one particular gel has the following composition, for very good results, including flowability and surface evenness:

	<u>Ingredients</u>	<u>Relative weights</u>
	(1) aliphatic urethane acrylate and tripropylene glycol diacrylate (Photomer 6008)	about 74%
5	(2) trimethylolpropane ethoxylate triacrylate (Photomer 4149)	about 10%
	(3) methacrylic acid (adhesion promoter)	about 10%
10	(4) 1-hydroxycyclohexylphenyl ketone (Irgacure) (photo initiator)	about 5%
15	(5) butyl acetate (volatile, for flowability, increased adhesion to nail tips, and reduced brittleness)	about 1%

The above ingredients, in base gel form, may vary somewhat in weight percent; however, ingredient (5) is kept at between .5 and 1.5 weight percent for maximum flowability and evenness of coating application.

The carbon chain lengths of (1) and (2) ingredients are as follows:

- (1) 5 to 20 carbon atoms (aliphatic urethane acrylate)
- (2) 12 to 18 carbon atoms

The base gel is sold by International Beauty Design Inc., Gardena, California, under the trademark "SOFT-LIGHT GEL" and has the following physical properties:

Boiling point: Does not pour at 10°C

% Volatiles by volume: < 1

Solubility in H₂O: Insoluble

Evaporation Rate Butyl Acetate = 1):

5 Negligible

Viscosity: 48-4 37,000 cps at 25°C

40-1 117,000 cps at 25°C

Flash Point: 190°F

The layer 12 may also contain colorant
10 particles distributed throughout the gel to form a mix,
the particles having powder size and forming with the
gel a hard, durable polish matrix when the mix is
applied as a layer on the nail and hardened under said
ultraviolet radiation. The particles preferably
15 consist essentially of pigments such as metal salts,
such as selected from the group iron oxide (rusty red),
mica bismuth oxychloride, titanium dioxide manganese
oxide (violet), carbon black, chrome yellow primrose,
pigment scarlet, alkali blue, cycloaliphatic dye
20 epoxides, dihydroxyl ether in selected proportions to
give the resultant hardened nail polish the desired
color.

The gel is allowed to cure under ultraviolet
radiation for a short time interval, i.e., between 30-
25 60 seconds, as indicated at 25.

Fig. 5 shows a fingernail 40, coated as
described, inserted into a recess 36a in a receptacle
36, the finger 40a placed on a shelf 37 in the
receptacle. An ultraviolet light bulb 38 at
30 predetermined distance above the fingernail emits

ultraviolet radiation 39 impinging on the nail. This treatment is continued to cure the gel coating to a hardened state in less than about 60 seconds. Thereafter, the treated nail is cleaned at 26, as with trichloroethane, and the resultant nail is presented at 27 in cleaned and hardened state.

Fig. 6 shows a polish matrix 40 as on a nail 41, with particles 42 uniformly distributed in the cured gel to form the tough, hardened, non-chipping, non-brittle nail polish matrix.

Fig. 1 also illustrates an alternative processing path, after step 25. Step 28 is the same as step 24, and comprises a second polish coat or layer application. The next steps 29 and 30 are the same as steps 25 and 26 described above. After cleaning at 30, the resultant very hard polished and protected nail is presented at 31.

A typical ultraviolet bulb 38 is of 4 watt power, delivers between .25 and .75 milliwatts per square centimeter (preferably about .5 milliwatts per cm^2) at the location of the fingernail, and at 260 manometers wavelength. Two such bulbs are typically employed.

Fig. 3 shows application of the process to a nail composite which includes the natural nail 10 of Fig. 2, and also a nail tip, i.e., artificial or plastic nail 100 attached at 101 to nail 10. See for example U.S. Patent 4,135,526 to Matranga et al. "Five Second" glue may be applied at 102 to the top surface junction between the nails 10 and 100. One such glue

is known as "KRAZY GLUE", a product of Krazy Glue, Inc., Itaska, Illinois. Primer 11, as referred to above, is applied to the natural nail, as described above; and primer 11a, as referred to above, is applied to the top surface of the nail tip. That primer may consist of SILANE, a product (A 187) of Union Carbide Corp.

The polish layer 12, as described above, is applied to the primer layers 11 and 11a as described above, but layer 11a should be slightly damp. The sequence 25-27 is then followed or in addition to sequence 28-31.

Fig. 4 shows application of the process to a nail 10 and nail form 200, i.e., support, projecting forwardly of nail 10. The form may be put in place after steps 20 and 21 of Fig. 1 are carried out. Sequence 22-27, or sequence 22-25 and 28-31, may be employed, after which the form is removed, whereby a hardened nail extension is provided as at 201. The polish layers extending at 204 forwardly of the natural nail are colored throughout, color being visible on top and bottom sides of the layers at 204.

It has further been found that very good results are achieved when the nail polish composition consists of one of the following Gel 1 through Gel 5:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
GEL 1	75-80	5-10	5-10	3-5	-	-	-
GEL 2	60-65	2-5	10-14	15-20	-	-	5.25
GEL 3	50-63	15-21	8-10	5-10	-	-	-
GEL 4	75-80	5-10	5-10	3-5	0.1-1.5	-	-

GEL 5 60-65 2-5 10-14 15-20 - 0.1-0.8 5-25

where (1) is weight percent aliphatic urethane acrylate

(2) is weight percent trimethylolpropane
ethoxylate triacrylate

5 (3) is weight percent methacrylic acid

(4) is weight percent 1-hydroxycyclohexylphenyl
ketone

(5) is weight percent colorant

(6) is weight percent colorant

10 (7) is fumed silica.

In this regard, the Gel 5 composition,
containing fumed silica, is found to be especially
advantageous when employing a nail form, as in Fig. 4
above. It produces a very strong, hardened, nail
15 extension as at 201 in Fig. 4.

The colorants in Gel 4 and Gel 5 include one
of the following pigments, or mixture of different ones
of the following pigments:

	TiO2 White	UCD 1066SF
20	Diarylide Yellow	UCD 5639SF
	Yellow Oxide	UCD 5752SF
	Lead Free Yellow	UCD 5767SF
	Organic Yellow	UCD 5696SF
	Red Oxide	UCD 6080SF
25	Arylide Red	UCD 7945SF
	Quinacridone Red	UCD 7959SF
	Phathalo Blue R	UCD 4830SF
	Phathalo Green B	UCD 5138SF
	Phathalo Green Y	UCD 5166SF
30	Carbon Black	UCD 507SF

Burnt Umber UCD 5861SF

Lead Free Orange UCD 6012SF

Quinacridone Violet UCD 8087SF

5 In this regard, the colorant typically also includes a polymer resin mixed with the pigment in the following proportions:

pigment - 40 to 20 weight percent

polymer resin - 30 to 60 weight percent

One usable polymer resin is polyester resin.

10 In the above, Gel 1 may be described as a clear gel; Gel 2 is a nail tip protector gel; Gel 3 is a nail cover gel; Gel 4 is a colored gel which, in the absence of colorant, is a clear gel; and Gel 5 is a nail hardening gel with colorant added. Also, the
15 colorants may be chosen and blended to achieve distinctive, personally appealing nail polish colors.

Finally, all of the Gel 1 through Gel 5 formulations fall within a composition formulation defined as:

- 20 (1) between 50 and 80 weight percent
aliphatic urethane acrylate
- (2) between 2 and 21 weight percent
trimethylolpropane ethoxylate
triacylate
- 25 (3) between 5 and 14 weight percent
methacrylic acid
- (4) between 3 and 20 weight percent 1-
hydroxycyclohexylphenyl ketone.

